EXHIBIT A

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November 20, 2000

I, Christian König, hereby swear, under penalty of perjury, that the attached document was translated by me and to the best of my knowledge and belief is a true and accurate translation of the corresponding German document:

Gebrauchsmuster G 93 05 552.8

(Christian König)

(19) Federal Republic of Germany
German Patent Office

(12) Utility model

U1 U

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(64) Subject matter
Device for inline-coating of materials to be printed in offset printing presses.

(71) Name and residence of proprietor
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Stamp:

Period for opposition:

Supervision			In case of opposition please send back to PW immediately
Access to records			
Opposition	X	H 8	
Conflict			
U 93/097AE			**E**

MAN Roland Druckmaschinen AG
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Device for inline-coating of materials to be printed in offset printing presses

The invention concerns a device for the coating of materials to be printed in multi-color offset printing presses with several coating stations.

The article "*Goldlackdruck löst Metall-Bronzierung ab*[1]" in the magazine *FlexoDruck*, 2-93, pages 42-43 describes the processing of gold lacquer in a multi-color offset printing press with two so-called coating towers. For this purpose, one of the coating towers was converted to a flexographic station, whereby a flexographic printing plate was used for coating, together with conventional lacquering technology. In regard to conventional metering methods for lacquer, the option of using a chamber doctor was pointed out.

DE 3 906 648 A1 describes an applicator unit for high-viscosity oil-based, or low-viscosity water-soluble layers. This applicator unit is configured as a coating unit, alternatively as an offset-, relief-, or intaglio-printing unit. These configurations are based on a textured pick-up roller, which is in contact with a doctor blade, or on an applicator roller and a textured form cylinder, which is in contact with a doctor blade. Hereby, the relief-printing unit consists of a pick-up roller that contains ink cells, and to which a doctor blade is assigned, a transfer roll, to which smoothing rolls are assigned, and a form cylinder that carries a relief form.

[1] Gold lacquer printing replaces metal-bronzing (The Translator)

DE 4 122 990 A1 describes a bronze- and effect printing ink and a process for bronze- or effect printing. It describes a water-soluble printing ink of high viscosity and high pigment content. This ink is to be processed out of the coating station of an offset machine or out of a flexographic station. The short processing path with few ink separations is listed as an advantage.

A so-called chamber doctor for applying a coating material onto a coating roller is well known, e.g. from DE 3 614 582 A1. At least two doctor blades are in contact with a roller and form a chamber for accepting a material, which is supplied under pressure.

Object of the invention is to further develop a coating station according to the characterizing portion of claim 1, to allow in a simple manner the problem-free inline processing of quickly evaporating printing inks with high pigment content or rough pigments in combination with further subsequent printing- and coating processing steps

This objective is solved by the characterizing portion of the independent claim. Further developments follow from the dependent claims.

This invention's solution makes it possible to carry out inline-coating in an offset printing press using high-viscosity liquids, with special consideration for water-based lacquers or pigmented inks (metallic gloss printing). Potential fields of application are the selective coating (spot coating) or the coating of complete areas. Evaporation of the employed liquids is reduced due to the closed design of the chamber of the chamber doctor. This improves the processing of quickly evaporating, e.g. water-soluble, liquids. The combination of several offset printing stations and at least one flexographic station can be implemented in various configurations, whereby as a rule an additional lacquering station, e.g. for the coating of solid areas, is positioned downstream of these devices.

In the following, the invention is explained by way of example.

Fig. 1 shows a first installation for coating, and

Fig. 2 shows a variant of the coating installation.

Figure 1 shows a multi-color offset printing press with two lacquering stations. The offset printing press (shown here without the feeder- and delivery attachments) consists of five printing stations 1 to 5, connected thereto in sheet running direction a coating station configured as a flexographic station 6, and downstream thereof a conventional lacquering station 7. Hereby, the flexographic station 6 can be employed as a spot coating device (for selective lacquering) and the downstream lacquering station 7 can be employed for solid-area surface finishing.

The flexographic station 6, as well as the lacquering station 7, each consist of one impression cylinder 8.1, 8.2, one transfer drum 9.1, 9.2, and one form cylinder 10.1, 10.2.

A flexible relief printing plate, e.g. a flexographic printing plate, is mounted on the form cylinder 10.1 in the flexographic station 6. An applicator roller 11 with a surface textured with ink cells, a so-called anilox roller, is in contact with the form cylinder 10.1. A doctor chamber 12 is associated with, and can be positioned on, the applicator roller 11. The doctor chamber 12 can, for example, be equipped with a supply inlet for liquids centered on its top panel and with two discharging outlets for liquids in its lateral areas. The liquid-supply inlet is connected to a feed pump, while the liquid-discharge outlets 11 are connected to a suction pump. The pumps are required to be able to process a liquid that is of high viscosity due to the pigmentation, e.g. a water-based liquid, such as for example gold- and silver printing ink, opaque white, or lacquer.

The ink cells of the applicator roller 11 transport the coating material for the inking of the relief form to the form cylinder 10.1, where the coating material is applied to the material to be printed that is being fed by the impression cylinder 8.1. While the applicator roller 11 provides for the transport of liquids, the chamber doctor ensures that the liquid remains only in the ink cells.

In contrast, the lacquering station 7 contains a roller pair that forms a metering nip. Herein, a metering roller 13 is positioned directly on an applicator roller 14. The coating substance is fed directly into the nip between the two rollers and is supplied to the form cylinder 10.2 by the applicator roller 14. At the impression cylinder 8.2, the form cylinder then applies the coating substance onto the material to be printed that is being supplied.

The staggered arrangement of offset printing, flexography, and lacquering yields very good operational results, especially in metal-gloss coatings. Hereby one must emphasize the combination of rapid processing of the quickly-evaporating metallic printing ink or printing lacquer and the subsequent coating with lacquer, which improves the gloss.

Fig. 2 shows a similar system. Here, the flexographic station 6 is employed upstream of the first printing station 1 of the offset printing press. Using such a configuration, it is possible to apply base-coatings prior to printing, e.g. opaque white coatings on sheet metal, plastic film, or card stock. Furthermore, the final lacquering can be achieved by placing a lacquering station 7 downstream of the final printing station 5, or by arranging an integrated lacquering unit with a conventional printing station.

Also comparable[2] is a placement of the flexographic station 6 within the offset printing press for applying intermediary coatings, for instance including a drying function.

[2] The German original suffers from poor grammar, which makes a determination of the exact meaning impossible. This interpretation assumes the German 'Vergleich' is meant to read 'Vergleichbar'. (The Translator)

Claims

1.) Device, preferably in sheet-fed rotary printing presses for multi-color offset printing for the coating of materials to be printed containing at least two lacquering stations,
whereby
each lacquering station comprises one impression cylinder (8), one form cylinder (10), and one applicator roller (11, 14), and the lacquering station that is upstream with respect to the sheet running direction is configured as a flexographic station (6).

2.) Device according to claim 1 wherein
the flexographic station (6) is equipped with an applicator roller (11), with which is associated an adjustable chamber doctor (12), whereby the applicator roller (11) is configured as an anilox roller.

3.) Device according to claim 1 and 2 wherein
a conventional lacquering station (7) is located directly or indirectly downstream of the flexographic station (6), and the lacquering station (7) is equipped with an applicator roller (14), with which is associated an adjustable metering roller (13) to form a common metering nip.

4.) Device according to claims 1 and 2 wherein
the flexographic station (6) consists of the following elements:
the form cylinder (10.1), which carries a relief form and is in contact with the impression cylinder (8.1), the applicator roller (11) with screen texture, which is in contact with the form cylinder (10.1), and the chamber doctor, which is equipped with a feed pump for liquid supply and a suction pump for liquid return.

5.) Device according to claims 1 and 2 wherein the flexographic station (6) in an offset printing press is placed in between the printing stations (1-5).

6.) Device according to claims 1 and 2 wherein the flexographic station (6) in an offset printing press is placed upstream of the printing stations (1-5).

7.) Device according to claims 1 and 2 wherein the flexographic station (6) in an offset printing press is placed downstream of the printing stations (1-5).

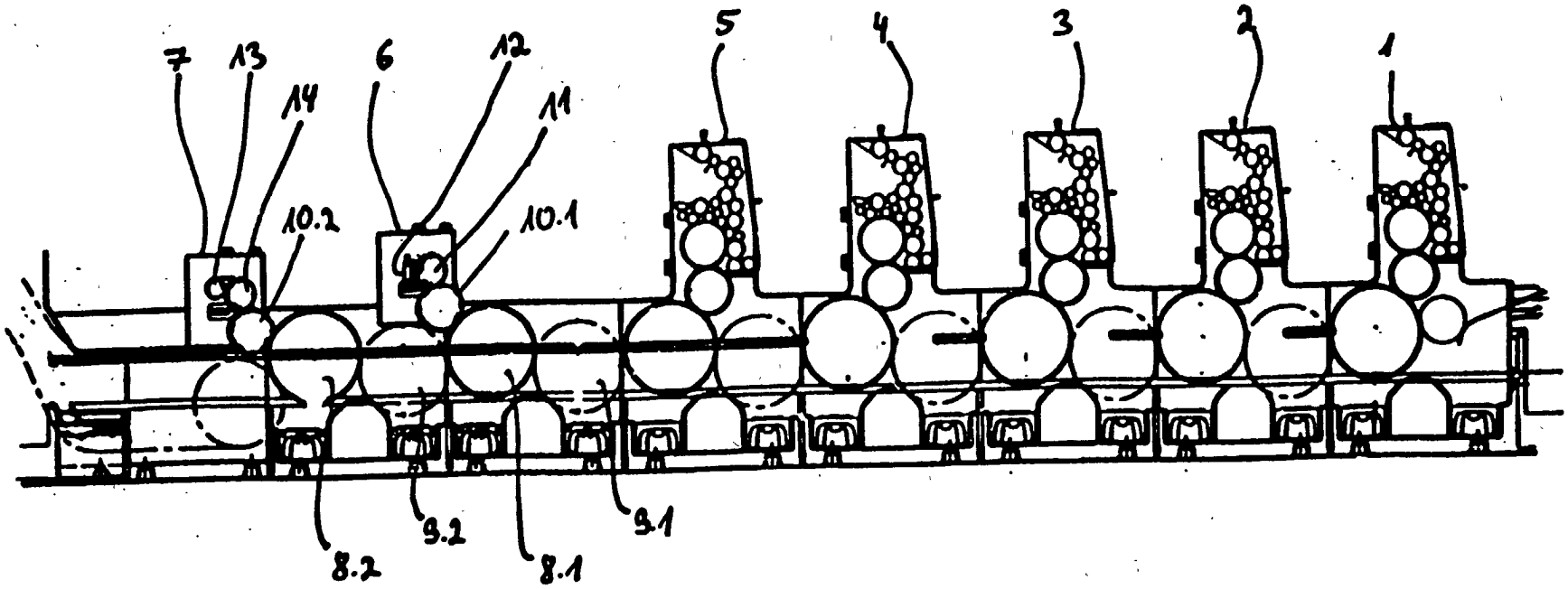

Fig. 1

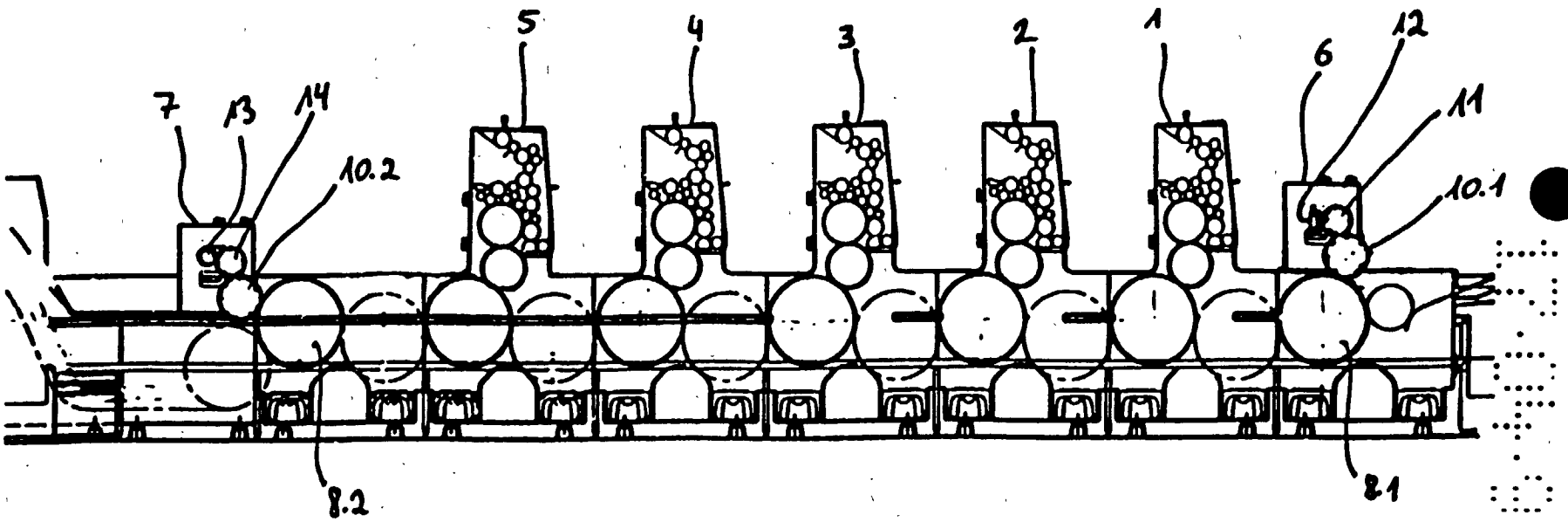

Fig. 2

EXHIBIT B

(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

(12) Gebrauchsmuster U1

(11) Rollennummer G 93 05 552.8

(51) Hauptklasse B41F 7/06

Nebenklasse(n) B41F 5/24 B41F 31/06

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(22) Anmeldetag 16.04.93

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(54) Bezeichnung des Gegenstandes
Einrichtung zum Inline-Beschichten von Bedruckstoffen in Offsetdruckmaschinen

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Einrichtung zum Inline-Beschichten von Bedruckstoffen in Offsetdruckmaschinen

Die Erfindung betrifft eine Einrichtung zum Beschichten von Bedruckstoffen in Mehrfarben-Offsetdruckmaschinen mit mehreren Lackierwerken.

In der Zeitschrift FlexoDruck, 2-93, Seite 42-43, ist im Artikel "Goldlackdruck löst Metall-Bronzierung ab" angegeben, daß in einer Mehrfarben-Offsetdruckmaschine mit zwei sogenannten Lacktürmen eine Goldlackfarbe verarbeitet wurde. Dazu wurde ein Lackturm als Flexodruckwerk umgerüstet, wobei mit konventioneller Lackiertechnik eine Flexodruckplatte zum Beschichten eingesetzt wurde. Gegenüber der konventionellen Lackdosierung wurde auf die Option zur Verwendung eines Kammerrakels hingewiesen.

Ein Auftragswerk für hochviskose, ölhaltige oder niedrigviskose wasserlösliche Schichten ist aus der DE 3 906 648 A1 bekannt. Dieses Auftragswerk ist als Lackiereinrichtung, wahlweise als Offset-, Hochdruck- oder Tiefdruckwerk ausgebildet. Die Ausführungen gehen von einer strukturierten Schöpfwalze aus, die mit einem Rakelblatt korrespondierend bzw. von einer Auftragwalze und einem strukturierten Formzylinder, der mit einem Rakelblatt korrespondiert. Das Hochdruckwerk besteht dabei aus einer mit Näpfchen profilierten Schöpfwalze, der ein Rakelblatt zugeordnet ist, einer Übertragwalze, der Glättwalzen zugeordnet sind und einem Formzylinder mit Hochdruckform.

Aus der DE 4 122 990 A1 sind eine Bronze- und Effektdruckfarbe und ein Verfahren zur Herstellung eines Bronze- und Effektdruckes

bekannt. Dort wird eine wasserverdünnbare Druckfarbe mit hoher Viskosität und hohem Pigmentanteil beschrieben. Diese soll aus dem Lackwerk einer Offsetmaschine oder einem Flexodruckwerk verarbeitet werden. Als Vorteil wird der kurze Verarbeitungsweg mit wenigen Farbspaltungen angegeben.

Beispielsweise aus der DE 3 614 582 A1 ist ein sogenanntes Kammerrakel zum Auftragen einer Beschichtungsmasse auf eine Beschichtungswalze bekannt. Mindestens zwei, an einer Walze anliegende, Rakelblätter bilden eine Kammer zur Aufnahme einer Masse, die unter Druck zugeführt wird.

Aufgabe der Erfindung ist es, eine Beschichtungseinrichtung nach dem Oberbegriff des Anspruchs 1 weiterzuentwickeln, um auf einfache Weise eine problemlose Inline-Verarbeitung von schnellverdunstenden Druckfarben mit hohem Pigmentanteil bzw. groben Pigmenten kombiniert mit weiterbehandelnden Druck- oder Beschichtungsvorgängen zu ermöglichen.

Gelöst wird die Aufgabe durch den kennzeichnenden Teil des Hauptanspruches. Weiterbildungen ergeben sich aus den Unteransprüchen.

Die erfindungsgemäße Lösung gestattet es, das Inline-Beschichten mit höherviskosen Flüssigkeiten in einer Offsetdruckmaschine vorzunehmen unter besonderer Berücksichtigung von Lacken bzw. pigmentierten Farben auf Wasserbasis (Metallglanzdrucke). Einsatzgebiete bestehen für ausgespartes Lackieren (Spotlackierung) oder vollflächiges Lackieren. Aufgrund der geschlossenen Kammer beim Kammerrakel wird die Verdunstung der verwendeten Flüssigkeit reduziert. Dadurch wird die Verarbeitung von schnell verdunstenden, z.B. wasserlöslichen Flüssigkeiten verbessert. Die Kombination von mehreren Offsetdruckwerken und mindestens einem Flexodruckwerk kann in unterschiedlichen Anordnungen erfolgen, wobei diesen Einrichtungen in der Regel eine weitere Lackiereinrichtung, z.B. zum vollflächigen Lackieren, nachgeordnet ist.

Die Erfindung wird im Folgenden beispielhaft erläutert. Dabei zeigt

Fig. 1 eine erste Einrichtung zum Beschichten und

Fig. 2 eine Variante der Einrichtung zum Beschichten.

In Figur 1 ist eine Mehrfarben-Offsetdruckmaschine mit zwei Lackiereinrichtungen gezeigt. Die Offsetdruckmaschine (hier ohne An- und Ausleger) besteht aus fünf Druckwerken 1 bis 5, daran in Bogenlaufrichtung angeschlossen einer als Flexodruckwerk 6 ausgerüsteten Beschichtungseinrichtung und einer dieser nachgeordneten herkömmlichen Lackiereinheit 7. Dabei kann das Flexodruckwerk 6 als Spotlackiereinrichtung (für ausgespartes Lackieren) und die nachgeordnete Lackiereinheit 7 zum vollflächigen Oberflächenfinishing eingesetzt werden.

Die Flexodruckwerk 6 wie auch die Lackiereinheit 7 bestehen aus je einem Druckzylinder 8.1, 8.2, einer Transfertrommel 9.1, 9.2 und einem Formzylinder 10.1, 10.2.

In der Flexodruckwerk 6 ist auf den Formzylinder 10.1 eine flexible Hochdruckplatte aufgespannt, zB. eine Flexodruckplatte. In Kontakt mit dem Formzylinder 10.1 ist eine Auftragwalze 11 mit strukturierter Oberfläche mit Rasternäpfchen, eine sogenannte Rasterwalze, angeordnet. An die Auftragwalze 11 anstellbar ist dieser ein Kammerrakel 12 zugeordnet. Das Kammerrakel 12 kann zB. an seiner Oberseite mittig mit einem Flüssigkeitszulauf und zwei austretende Flüssigkeitsabläufen im Bereich der Seitenteile versehen sein. Der Flüssigkeitszulauf ist mit einer Förderpumpe, die Flüssigkeitsabläufe 11 hingegen mit einer Saugpumpe verbunden. Die Pumpen sind erforderlich, um speziell durch die Pigmentierung höherviskose Flüssigkeit z.B. auf Wasserbasis, wie z.B. Gold- und Silberdruckfarbe, Deckweiß oder Lack, verarbeiten zu können.

Über die Rasternäpfchen der Auftragwalze 11 wird die Beschichtungsmasse zum Einfärben der Hochdruckform auf den Formzylinder

10.1 transportiert und auf den vom Druckzylinder 8.1 zugeführten Bedruckstoff aufgebracht. Während des von der Auftragwalze 11 bewirkten Flüssigkeitstransports sorgt die Kammerrakel 12 dafür, daß die Flüssigkeit ausschließlich in den Rasternäpfchen verbleibt.

Die Lackiereinheit 7 weist demgegenüber eine Walzenpaar zur Bildung eines Dosierspalts auf. Dabei ist eine Dosierwalze 13 an eine Auftragwalze 14 angestellt. Die Beschichtungsmasse wird direkt in den Spalt zwischen beiden Walzen eingeführt und über die Auftragwalze 14 dem Formzylinder 10.2 zugeführt. Dieser trägt sie dann am Druckzylinder 8.2 auf den zugeführten Bedruckstoff auf.

Durch die Staffelung Offsetdruck, Flexodruck und Lackieren ist speziell für Metallglanz-Beschichtungen ein besonders gutes Arbeitsergebnis erzielbar. Dabei ist die Kombination von schneller Verarbeitung der leicht verdunstenden Metalldruckfarbe bzw. des Drucklacks mit einer nachträglichen, den Glanz erhöhenden Lackbeschichtung hervorzuheben.

Ein vergleichbares System ist in Figur 2 dargestellt. Hier ist das Flexodruckwerk 6 vor dem ersten Druckwerk 1 der Offsetdruckmaschine eingesetzt. Mit einer derartigen Konfiguration lassen sich Basisbeschichtungen vor dem Drucken aufbringen, z.B. Deckweiß-Beschichtungen auf Blechmaterial, Kunststoffolie oder Karton. Die abschließende Lackierung kann weiterhin dadurch ermöglich werden, daß ein Lackierwerk 7 nach dem letzten Druckwerk 5 oder auch ein intergriertes Lackierwerk an einem konventionellen Druckwerk angeordnet ist.

Vergleich ist auch eine Anordnung des Flexodruckwerkes 6 innerhalb der Offsetdruckmaschine zum Aufbringen von Zwischenbeschichtungen etwa mit Trocknungsfunktion.

17.04.93

Ansprüche

1.) Einrichtung vorzugsweise in Bogenrotationsdruckmaschinen für mehrfarbigen Offsetdruck zum Beschichten von Bedruckstoffen mit wenigstens zwei Lackiereinheiten,
d a d u r c h g e k e n n z e i c h n e t,
daß jede Lackiereinheit einen Druckzylinder (8), einen Formzylinder (10) und eine Auftragwalze (11,14) enthält und die entsprechend Bogenlaufrichtung vorgeordnete Lackiereinheit als Flexodruckwerk (6) ausgebildet ist.

2.) Einrichtung nach Anspruch 1,
d a d u r c h g e k e n n z e i c h n e t,
daß im Flexodruckwerk (6) eine Auftragwalze (11) vorgesehen ist, an die ein Kammerrakel (12) anstellbar angeordnet ist, wobei die Auftragwalze (11) als Rasterwalze ausgebildet ist.

3.) Einrichtung nach Anspruch 1 und 2,
d a d u r c h g e k e n n z e i c h n e t,
daß dem Flexodruckwerk (6) eine konventionelle Lackiereinheit (7) direkt oder indirekt nachgeordnet ist und in der Lackiereinheit (7) eine Auftragwalze (14) vorgesehen ist, der eine Dosierwalze (13) zur Bildung eines gemeinsamen Dosierspaltes anstellbar zugeordnet ist.

4.) Einrichtung nach Anspruch 1 und 2,
d a d u r c h g e k e n n z e i c h n e t,
daß das Flexodruckwerk (6) aus folgenden Elementen besteht: dem, eine Hochdruckform tragenden Formzylinder (10.1), der mit dem Druckzylinder (8.1) in Kontakt steht, der Auftragwalze (11) mit Rasterstruktur, die mit dem Formzylinder (10.1) in Kontakt steht und dem Kammerrakel (12) besteht, das mit einer

Förderpumpe zur Flüssigkeitszufuhr und einer Saugpumpe zur Flüssigkeitsrückführung verbunden ist.

5.) Einrichtung nach Anspruch 1 und 2,
d a d u r c h   g e k e n n z e i c h n e t,
daß das Flexodruckwerk (6) in einer Offsetdruckmaschine zwischen den Druckwerken (1-5) angeordnet ist.

6.) Einrichtung nach Anspruch 1 und 2,
d a d u r c h   g e k e n n z e i c h n e t,
daß das Flexodruckwerk (6) in einer Offsetdruckmaschine den Druckwerken (1-5) vorgeordnet ist.

7.) Einrichtung nach Anspruch 1 und 2,
d a d u r c h   g e k e n n z e i c h n e t,
daß das Flexodruckwerk (6) in einer Offsetdruckmaschine den Druckwerken (1-5) nachgeordnet ist.

EXHIBIT C

EXHIBIT D

LEGAL EXPERT'S REPORT
ON GERMAN UTILITY MODELS

My name is Lars Manke and my curriculum vitae is attached. I am a partner with the patent law firm UEXKÜLL & STOLBERG and have 8 years experience in patent law and utility model law. I have been retained as an expert of witness by the law firm of LOCKE, LIDELL and SAPP. My compensation is $ 200 per hour.

I, Lars Manke, hereby declare that:

In generall, German utility models (Gebrauchsmuster) are similar to German patents. Like German patents, a German utility model contains a description, claims and drawings (no abstract is required). The maximum lifetime of a German utility model is 10 years, instead of 20 years for a German patent. Further, the definition of "inventive step" is slightly different.

Contrary to a German patent, a German utility model does not go through substantive examination but is registered upon passing the formal examination. Usually, the registration occurs between two and three month after the date of filing. The date of registration is published in the official PATENT GAZETTE (Patentblatt) and in the unofficial UTILITY MODEL BULLETIN (Auszüge aus den Gebrauchsmustern).

The publication of the unofficial UTILITY MODEL BULLETIN occurs on the same day the registration of the utility model is published in the official PATENT GAZETTE.

The publication of the registration of a German utility model in the official PATENT GAZETTE does not contain explicit

details on the subject matter of the utility model; it shows the bibliographic data. The PATENT GAZETTE is the official publication of the German Patent and Trademark Office, and is printed by a publisher (Carl Heymanns Verlag) in Munich.

The unofficial UTILITY MODEL BULLETIN is printed and published by another publisher (WILA Verlag) in Munich. The UTILITY MODEL BULLETIN contains more detailed information, i.e. a drawing and claim 1 of the respective utility model.

Generally, both publications may be ordered directly from the publishers by any third party for whichever purposes. The PATENT GAZETTE is printed with a volume of approximately 700 copies per week, the UTILITY MODEL BULLETIN only with a volume of approximately 80 per week.

The unofficial UTILITY MODEL BULLETIN is available to the public through at least the German Patent Office, through the "Bayrische Staatsbibliothek" (Bavarian State Library) in Munich and through the "Deutsche Bibliothek" (German Library) in Frankfurt. Further, about 60 to 70 companies and law firms order the UTILITY MODEL BULLETIN for own inspection purposes.

The official PATENT GAZETTE is available to the public through several universities and other institutions who order the PATENT GAZETTE for own inspection purposes.

The German utility model G 93 05 552.8 with the German title "Einrichtung zum Inline-Beschichten von Bedruckstoffen in Offsetdruckmaschinen" (English title: "Device for in-line coating of printed materials in printing machines") has been filed on April 16, 1993. The date of registration was June 3, 1993. The registration has been published in the official PATENT GAZETTE and in the unofficial UTILITY MODEL BULLETIN on July 15, 1993.

From the date of the registration (June 3, 1993) of the above German utility model, a list was available at the German Patent Office, on which the publication number, the main class and the date of registration of all German utility models are cited which have been registered at that day (June 3, 1993) including the publication number, the main class and the date of registration of the utility model in question.

From the above date of registration, any third party had the opportunity to file a request for inspection of file for the utility model in question. This means, from the date of registration (June 3, 1993), any third party had the opportunity to get knowledge of the content of the above utility model in question.

As already mentioned, the publication of the registration of a German utility model in the official PATENT GAZETTE and the unofficial UTILITY MODEL BULLETIN occurs a few weeks after the registration thereof. This date of the publication of the registration (July 15, 1993) was the day when the above utility model was open to the public and could be inspected by any third party. There is no printed copy of the German utility model, but is on microfiche. However, any third party had the opportunity to order a printed copy of the whole specification of the above utility model from the German Patent and Trademark Office.

The above declaration and any oppinions herein are based on my knowledge of the German utility model law ("Gebrauchsmuster-gesetz"), my experience as a German patent attorney, my German patent practice, my knowledge of the German Patent Office and my knowledge of Carl Heymanns Verlag and WILA Verlag. I have not testified or given a deposition for the last four years.

Attachments to this report are German utility model G 93 05 552.8, the mention of registration of the utility model in the PATENT GAZETTE and the unofficial UTILITY MODEL BULLETIN published July 15, 1993. It is expected that an English translation of the German utility model G 93 05 552.8 will be available in a supplement.

Munich, November 16, 2000 .....
(Lars Manke)

LARS MANKE

Curriculum Vitae

Personal Data:

Date of Birth: June 19, 1965 in Oldenburg, Germany

Address: Amalienstraße 40, 80799 Munich, Germany

Education and Professional Experience:

1987 - 1992:	University of Braunschweig (Diploma in Electrical Engineering)
1992 - 1993:	Research and Development at VOLKSWAGEN in Braunschweig
1993 - 1995:	Education at UEXKÜLL & STOLBERG, Patent Attorneys in Hamburg
1995 - 1996:	Industrial Property Study Program organized by the German Patent and Trademark Office
1996 - 1999:	Associate at UEXKÜLL & STOLBERG, Patent Attorneys in Hamburg
since 1996:	Registered to practice before the German Patent and Trademark Office
since 1996:	Registered to practice before the Federal Court
since 1996:	Registered to practice before the European Community Trademark Office
since 1998:	Registered to practice before the European Patent Office
since 2000:	Partner at UEXKÜLL & STOLBERG, Patent Attorneys in Munich

Member:

- German Patent Attorney Bar Association of German Patent Attorneys
- Institute of Professional Representatives before the European Patent Office (EPI)
- International Federation of Industrial Property Attorneys (FICPI)
- German Association for the Protection of Industrial Property and Copyright Law (GRUR)
- International Association for the Protection of Industrial Property (AIPPI)

Lars Manke is a partner at UEXKÜLL & STOLBERG, Patent Attorneys. He has 8 years of practice in intellectual property law, beginning with his education at UEXKÜLL & STOLBERG, one of the leading patent law firms in Germany. Since one year he is a partner at UEXKÜLL & STOLBERG and founded the branch office in Munich. His practice consists primarily of preparation and prosecution of patent applications, utility model applications and trademark applications before the German Patent Office and the European Patent Office. Other areas of his expertise include patent and trademark licensing and counseling clients regarding all phases of intellectual property.

Munich, November 16, 2000 .....
(Lars Manke)

EXHIBIT E

atomen oder ein Terpolymeres von Ethylen und Propylen und Butylen oder Ethylen und Propylen und einem anderen α-Olefin mit 5 bis 10 Kohlenstoffatomen oder eine Mischung aus zwei oder mehreren der genannten Homo-, Co- und Terpolymeren oder ein Blend aus zwei oder mehreren der genannten Homo-, Co- und Terpolymeren ist und die Folie matt ist.

B 32 B – 27/40 91 16 632 A 41 D – 31/02

Klasse B 41

B 41 F – 5/24 93 05 552 B 41 F – 7/06

(51) B 41 F – 7/06 (11) DE 93 05 552 U 1
(22) 16.04.93 (47) 03.06.93 (43) 15.07.93

(54) **Einrichtung zum Inline-Beschichten von Bedruckstoffen in Offsetdruckmaschinen**

(71) MAN Roland Druckmaschinen AG, 6050 Offenbach, DE
(74) Marek, J., Dipl.-Ing., Pat.-Ass., 6053 Obertshausen

(51) B 41 F – 5/24 B 41 F – 31/06
B 41 F – 9/10 B 41 F – 9/16
B 05 C – 1/08

(57) 1. Einrichtung, vorzugsweise in Bogenrotationsdruckmaschinen für mehrfarbigen Offsetdruck, zum Beschichten von Bedruckstoffen mit wenigstens zwei Lackiereinheiten, dadurch gekennzeichnet, daß jede Lackiereinheit einen Druckzylinder (8), einen Formzylinder (10) und eine Auftragwalze (11, 14) enthält und die entsprechend Bogenlaufrichtung vorgeordnete Lackiereinheit als Flexodruckwerk (6) ausgebildet ist.

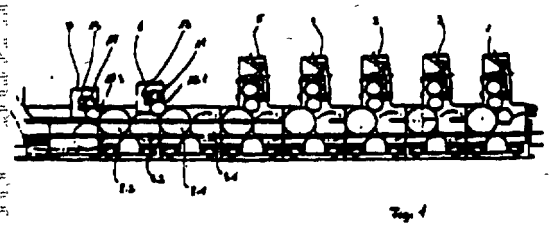

Fig. 1

B 41 F – 9/10 93 05 552 B 41 F – 7/06

(51) B 41 F – 9/10 (11) DE 92 18 039 U 1
(22) 25.04.92 (47) 03.06.93 (43) 15.07.93

(54) **Rakelbalken für ein Kurzfarbwerk einer Rollenrotationsdruckmaschine**

(71) Koenig & Bauer AG, 8700 Würzburg, DE

(57) 1. Rakelbalken für ein Kurzfarbwerk einer Rollenrotationsdruckmaschine, welcher unterhalb einer Rasterwalze angeordnet und in vertikaler Richtung an den Rakelbalken anstellbar ist, und dessen Rakelblätter einen negativen Anstellwinkel aufweisen, dadurch gekennzeichnet, daß zumindest ein Rakelblatt (2) in einer rasterwalzenfernen Stellung gegen die Kraft von Federn (31) arretierbar ist.

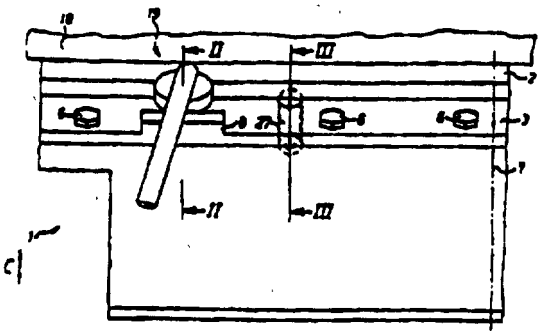

Fig. 1

(51) B 41 F – 9/10 (11) DE 92 18 053 U 1
(22) 25.04.92 (47) 03.06.93 (43) 15.07.93

(54) **Einrichtung zum Festklemmen und Anstellen eines Rakelbalkens an eine farbabgebende Walze einer Rollenrotationsdruckmaschine**

(71) Koenig & Bauer AG, 8700 Würzburg, DE

(51) B 41 F – 13/08

(57) 1. Einrichtung zum Festklemmen und Anstellen eines Rakelbalkens an eine farbabgebende Walze, z.B. Rasterwalze, einer Rollenrotationsdruckmaschine, dadurch gekennzeichnet, daß ein drehbar in einer gestellfesten Rakelbalkenhalterung (22; 23) angeordneter Körper (24) eine abgewinkelte Gabel (26; 27) mit zwei Armen (26; 27) aufweist, daß in den Enden der Arme (26; 27) ein Bolzen (28) gelagert ist, auf dem ein zweiarmiger Hebel (29) angeordnet ist, der an seinem ersten Ende einen Anschlag (31) und an seinem zweiten Ende einen Exzenter (32) aufweist, daß der Exzenter (32) gegen eine Frontseite (74) des Rakelbalkens (9 bis 13) preßbar ist, daß ein auf die Hinterseite (76) des Rakelbalkens (9 bis 13) wirkendes Druckfederstück (63) vorgesehen ist, daß ein hinterer Anschlag (23) als Gegenlager für den Rakelbalken (9 bis 13) angeordnet ist.

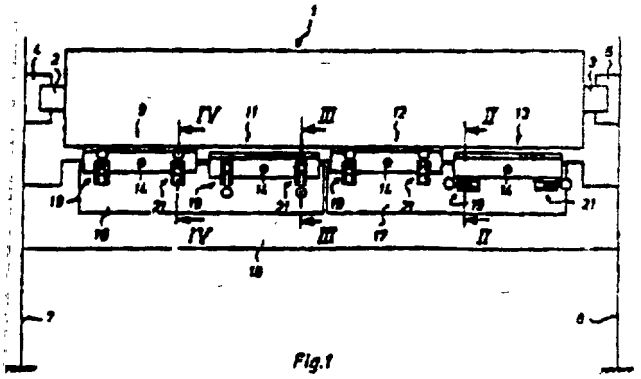

Fig.1

B 41 F – 9/16 93 05 552 B 41 F – 7/06
B 41 F – 13/08 92 18 053 B 41 F – 9/10
B 41 F – 13/08 92 18 057 B 41 F – 13/10

(51) B 41 F – 13/08 (11) DE 92 18 056 U 1
(22) 21.04.92 (47) 03.06.93 (43) 15.07.93

(54) **Vorrichtung zum Erzeugen eines druckenden Musters auf einer Druckform-Hülse**

(71) Albert-Frankenthal AG, 6710 Frankenthal, DE

(51) B 41 F – 13/10

(57) 1. Vorrichtung zum Erzeugen eines druckenden Musters auf einem Mantel einer Druckform-Hülse mittels einer Einrichtung zur Erzeugung von kleinen, Druckfarbe transportierenden Stellen auf dem Mantel, wobei die Druckform-Hülse auf einen Zylinder aufgefädelt wird, dadurch gekennzeichnet, daß ein innerer Umfang der Druckform-Hülse (4) größer als ein Durchmesser des Zylinders (8) ist.

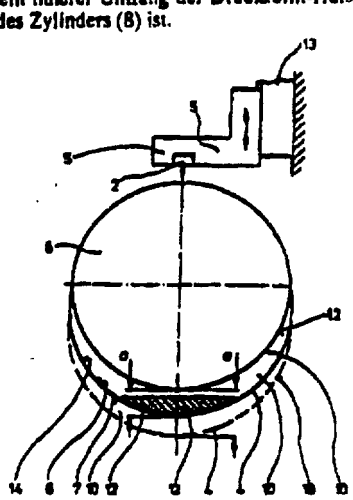

Fig.1

B 41 F – 13/10 92 18 056 B 41 F – 13/08

GWK Gesellschaft Wärme Kältetechnik mbH, 5883 Kierspe, DE

B29C 51/08 GM 92 15 136
B31D 5/02
B31F 1/12
B31F 1/36
B31B 43/00
B31B 1/00
B65D 65/40
AT 06.11.92 ET 03.06.93 BT 15.07.93
Akz: G 92 15 136.1
Anlage zur Herstellung von Formkörpern aus einem verformbaren Folienmaterial o.dgl.
LMG Rotopack GmbH, 7000 Stuttgart, DE
R

B29C 51/42 GM 93 04 203
AT 20.03.93 ET 03.06.93 BT 15.07.93
Akz: G 93 04 203.5
Vorrichtung zum Erwärmen von Tiefziehfolien
Hemmerle Maschinen- und Werkzeugbau, 7951 Tannheim, DE

B29C 65/60 GM 93 04 246 B21J 15/50

B29C 67/12 GM 93 02 413 B29C 43/48

B30B 9/30 GM 92 17 343
B65F 1/14
AT 18.12.92 ET 03.06.93 BT 15.07.93
Akz: G 92 17 343.8
Blechdosenverdichtungsmaschine
Huber, Max, 8058 Erding, DE

B31B 1/00 GM 92 15 136 B29C 51/08

B31B 1/62 GM 93 04 390 B31F 1/26

B31B 43/00 GM 92 15 136 B29C 51/08

B31D 5/02 GM 92 15 136 B29C 51/08

B31F 1/12 GM 92 15 136 B29C 51/08

B31F 1/26 GM 93 04 390
B31B 1/62
B31F 1/28
D21F 11/12
AT 23.03.93 ET 03.06.93 BT 15.07.93
Akz: G 93 04 390.2
Pr 23.03.92 IT MI 92 U 000265
Wellmaschine zur Herstellung von Wellpappe mit unterschiedlichen Profilen
Ingg. Terzaghi & de Castiglione Industriale S.p.A., Cernusco sul Naviglio, Milano, IT
Vtr: Manitz, G., Dipl.-Phys. Dr.rer.nat.; Finsterwald, M., Dipl.-Ing. Dipl.-Wirtsch.-Ing., 8000 München; Rotermund, H., Dipl.-Phys., 7000 Stuttgart; Heyn, H., Dipl.-Chem. Dr.rer.nat., Pat.-Anwälte, 8000 München

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B31F 1/28 GM 93 04 390 B31F 1/26

B31F 1/36 GM 92 15 136 B29C 51/08

B32B 3/24 GM 93 03 118 B32B 11/10

B32B 7/12 GM 91 16 632 A41D 31/02

B32B 11/10 GM 93 03 118
B32B 3/24
B32B 27/06
B32B 15/08
D06N 7/00
E04D 5/10
E04B 1/66
C09K 3/10
AT 04.03.93 ET 03.06.93 BT 15.07.93
Akz: G 93 03 118.1
IP 05.02.93 DE 93 01 569.0
Rollbare Abdichtbahn für insbesondere Dächer
Roland-Werke Dachbaustoffe u. Bauchemie GmbH & Co KG, 2807 Achim, DE

B32B 15/08 GM 93 03 118 B32B 11/10

B32B 27/06 GM 93 03 118 B32B 11/10

B32B 27/12 GM 91 16 632 A41D 31/02

B32B 27/18 GM 93 05 684 B32B 27/32

B32B 27/32 GM 93 05 684
B32B 27/18
AT 17.04.93 ET 03.06.93 BT 15.07.93
Akz: G 93 05 684.2
Matte Transfermetallisierungsfolie
Hoechst AG, 6230 Frankfurt, DE

B32B 27/40 GM 91 16 632 A41D 31/02

B41F 5/24 GM 93 05 552 B41F 7/06

B41F 7/06 GM 93 05 552
B41F 5/24
B41F 31/06
B41F 9/10
B41F 9/16
B05C 1/08
AT 16.04.93 ET 03.06.93 BT 15.07.93
Akz: G 93 05 552.8
Einrichtung zum Inline-Beschichten von Bedruckstoffen in Offsetdruckmaschinen
MAN Roland Druckmaschinen AG, 6050 Offenbach, DE

B41F 9/10 GM 92 18 039
AT 25.04.92 ET 03.06.93 BT 15.07.93
AT aus P 42 13 663.6
Akz: G 92 18 039.6
Rakelbalken für ein Kurzfarbwerk einer Rollenrotationsdruckmaschine
Koenig & Bauer AG, 8700 Würzburg, DE

B41F 9/10 GM 92 18 053
B41F 13/08
AT 25.04.92 ET 03.06.93 BT 15.07.93
AT aus P 42 13 670.9
Akz: G 92 18 053.1
Einrichtung zum Festklemmen und Anstellen eines Rakelbalkens an eine farbabgebende Walze einer Rollenrotationsdruckmaschine
Koenig & Bauer AG, 8700 Würzburg, DE

B41F 9/10 GM 93 05 552 B41F 7/06

B41F 9/16 GM 93 05 552 B41F 7/06

B41F 13/08 GM 92 18 053 B41F 9/10

B41F 13/08 GM 92 18 056
B41F 13/10
AT 21.04.92 ET 03.06.93 BT 15.07.93
AT aus P 42 13 013.1
Akz: G 92 18 056.6
Vorrichtung zum Erzeugen eines druckenden Musters auf einer Druckform-Hülse
Albert-Frankenthal AG, 6710 Frankenthal, DE

B41F 13/08 GM 92 18 057 B41F 13/10

B41F 13/10 GM 92 18 056 B41F 13/08

B41F 13/10 GM 92 18 057
B41F 13/08
AT 21.04.92 ET 03.06.93 BT 15.07.93
AT aus P 42 13 012.3
Akz: G 92 18 057.4
Rollenrotationsdruckmaschine - Druckwerk
Albert-Frankenthal AG, 6710 Frankenthal, DE

B41F 16/02 GM 92 01 247 D06C 23/00

B41F 17/00 GM 93 03 439
B41M 1/40
AT 09.03.93 ET 03.06.93 BT 15.07.93
Akz: G 93 03 439.3
Tampendruckmaschine
Tampoprint GmbH, 7015 Korntal-Münchingen, DE
R

B41F 23/04 GM 91 16 646
B41F 25/00
AT 07.06.91 ET 03.06.93 BT 15.07.93
AT aus P 41 18 807.1
Akz: G 91 16 646.2
Vorrichtung zur Erhöhung des Wärmeübergangs an Kühlwalzen von Offset-Rollenrotationsmaschinen
Eltex-Elektrostatik GmbH, 7858 Weil, DE

B41F 25/00 GM 91 16 646 B41F 23/04

B41F 31/06 GM 93 05 552 B41F 7/06

B41J 2/455 GM 93 05 092 G03G 15/08

B41J 5/10 GM 93 02 619 G06F 3/023

B41L 11/00 GM 93 05 092 G03G 15/08

B41M 1/40 GM 93 03 439 B41F 17/00

B42C 9/02 GM 93 04 504
B05C 1/08
AT 26.03.93 ET 03.06.93 BT 15.07.93
Akz: G 93 04 504.2
Radauftragsgerät zum Auftragen von Klebstoff, insbesondere auf Buchrücken beim Buchbinden
Nordson Corp., Westlake, Ohio, US
Vtr: Eisenführ, G., Dipl.-Ing.; Speiser, D., Dipl.-Ing.; Rabus, W., Dr.-Ing.; Brügge, J., Dipl.-Ing., Pat.-Anwälte, 2800 Bremen

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EXHIBIT F

PATENT
Our File: WILL 2501

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Reissue Application of:	§	
BILL L. DAVIS and JESSE S. WILLIAMSON	§	
	§	
For Reissue of U. S. Patent 5,630,363	§	Group Art Unit: 2854
Issued May 20, 1997	§	
Serial No. 08/515,097	§	
	§	
Filing Date: May 20, 1999	§	Examiner: S. Funk
	§	J. Hilten
	§	
Serial No.: 09/315,796	§	
	§	
For: **COMBINED LITHOGRAPHIC/ FLEXOGRAPHIC PRINTING APPARATUS AND PROCESS**	§	

AMENDED CUT-UP SPECIFICATION UNDER 37 C.F.R. §1.173

TO: The Honorable Commissioner of
Patents and Trademarks
Washington, D.C. 20231

SIR:

Reissue Applicants Davis and Williamson and their assignee of record Williamson Printing Co., hereby submit a revised cut-up specification and claims of the reissue application. The matter to be omitted is enclosed in brackets, the matter to be added is underlined. The original claims have not been renumbered.

Pursuant to 37 C.F.R. §1.174. a copy of the printed drawings of the '363 patent is attached.

Note: Bracketed material in the following claims has been deleted from U.S. Patent 5,630.363 as issued; underlined materials, including new claims 42-87 has been added.

[75] Inventors: **Bill L. Davis**, Irving; **Jesse S. Williamson**, Dallas, both of Tex.

[73] Assignee: **Williamson Printing Corporation**, Dallas, Tex.

[21] Appl. No.: **515,097**

[22] Filed: **Aug. 14, 1995**

[51] **Int. Cl.**[6] **B41M 1/18**; B41M 7/00; B41M 1/04; B41F 23/00

[52] **U.S. Cl.** **101/141**; 101/181; 101/183; 101/424.1; 101/424.2; 101/479; 101/483; 101/491; 101/DIG. 49

[58] **Field of Search** .... 101/135-138, 101/141-143, 450.1, 174, 180, 181, 183, 416.1, 424.1, 424.2, 479, 491, DIG. 29, DIG. 49, 483

[56] **References Cited**

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"Pantone® Metallic Integrated Process Color Selector, Pantone Metallic-Buntdruck-Farbskala", The Pantone Library of Color, 201 Pantone, Inc. 1990, pp. MIPP VI-VIII.

Primary Examiner—Stephen R. Funk
Attorney, Agent, or Firm—Jones, Day, Reavis & Pogue

[57] **ABSTRACT**

A combined lithographic/flexographic printing process having a plurality of successive printing stations for printing color images on a substrate in a continuous in-line process. One of the stations prints a first color image using the flexographic process and at least one of the successive printing stations prints a second color image over the first color image using an offset lithographic process in the continuous in-line process.

41 Claims, 1 Drawing Sheet

COMBINED LITHOGRAPHIC/ FLEXOGRAPHIC PRINTING APPARATUS AND PROCESS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates in general to printing machines and processes and in particular to a combined lithographic/flexographic in-line printing apparatus and process.

2. Description of Related Art

As used herein, the following terms have the meanings indicated:

ANILOX ROLLER

A steel or ceramic ink metering roller. Its surface is engraved with tiny, uniform cells that carry and deposit a thin, controlled layer of ink film or coating material onto the plate. In flexo [flexographic] presswork, anilox rollers transfer a controlled ink film from the rubber plate (or rubber-covered roller) to the web to print the image. Anilox rollers are also used in remoistenable glue units and to create "scratch-and-sniff" perfume ads.

ANILOX SYSTEM

The inking method commonly employed on flexographic presses. An elastomer-covered fountain roller supplies a controlled ink film from the ink pan to the engraved metering roller. After ink floods the metering roller, the fountain roller is squeezed or wiped usually with a doctor blade to remove the excess ink. The ink that remains on the metering roller is then transferred to the rubber printing plate.

COATER

A device with a pan to contain the coating material, a pan roller partially immersed in the coating material contained in the pan, and a coater roller to meter off a uniform film of the coating material and apply it to the printing plate.

COATING

An unbroken, clear film applied to a substrate in layers to protect and seal it, or to make it glossy.

FLEXOGRAPHIC INK

A quick-drying, fluid ink that is highly volatile or an ink that can be water based and nonvolatile.

FLEXOGRAPHY

A method of rotary letterpress printing characterized by the use of flexible, rubber, or plastic plates with raised image areas and fluid, rapid-drying inks.

HALFTONES

Dot-pattern images that have the appearance of continuous-tone images because of the limited resolving power of the human eye. This limitation accounts for an optical illusion; small halftone dots, when viewed at the normal reading distance, cannot be resolved as individual dots but blend into a continuous tone.

LITHOGRAPHIC PLATES

A lithographic plate is precoated with a light-sensitive or otherwise imageable coating, and the separation between the image and nonimage areas is maintained chemically. The image areas must be ink receptive and refuse water and the nonimage areas must be water receptive and refuse ink. The wider the difference maintained between the ink receptivity of the image areas and the water receptivity of the nonimage areas, the better the plate will be, the easier it will run on the press, and, consequently, the better the printing. There are several types of lithographic plates. The plate is an image carrier that is said to be planographic, or flat and smooth.

LITHOGRAPHY

A printing process in which the image carrier or plate is chemically treated so that the image areas are receptive to ink.

OFFSET PRINTING

An indirect printing method in which the inked image on a press plate is first transferred to a rubber blanket, that in turn "offsets" the inked impression to a press sheet. In offset lithography, the printing plate has been photochemically treated to produce image areas receptive to ink.

SLURRY

A water suspension of fibers or the suspension of pigment and adhesive used to coat papers. It may also include a suspended metallic material such as uniform-sized metal particles or nonuniform-sized metal particles.

ULTRAVIOLET INKS

Printing inks containing an activator that causes the polymerization of binders and solvents after exposure to a source of ultraviolet radiation.

Offset lithography is a process that is well known in the art and utilizes the planographic method. This means that the image and nonprinting areas are essentially on the same plane of a thin metal plate and the distinction between them is maintained chemically. There are two basic differences between offset lithography and other processes. First, it is based on the principle that grease and water do not mix. Second, the ink is offset from the first plate to a rubber blanket and then from the blanket to a substrate on which printing is to occur such as paper.

When the printing plate is made, the printing image is made grease receptive and water repellant and the nonprinting areas are made water receptive and ink repellant. The plate is mounted on the plate cylinder of the press which, as it rotates, comes in contact successively with rollers wet by a water or dampening solution and rollers wet by ink. The dampening solution wets the nonprinting areas of the plate and prevents the ink from wetting these areas. The ink wets the image areas which are transferred to the intermediate blanket cylinder. The inked image is transferred to the substrate as it passes between the blanket cylinder and the impression cylinder. Transferring the image from the plate to a rubber blanket before transfer to the substrate is called the offset principle.

One major advantage of the offset principle is that the soft rubber surface of the blanket creates a clearer impression on a wide variety of paper surfaces and other substrate materials with both rough and smooth textures with a minimum of press preparation.

Offset lithography has equipment for short, medium and long runs. Both sheetfed and web presses are used. Sheetfed lithography is used for printing advertising, books, catalogs, greeting cards, posters, labels, packaging, folding boxes, decalcomanias, coupons, trading stamps, and art reproductions. Many sheetfed presses can perfect (print both sides of the paper) in one pass through the press. Web offset is used for printing business forms, newspapers, preprinted newspaper inserts, advertising literature, catalogs, long-run books, encyclopedias, and magazines.

In offset lithography, the rubber blanket surface conforms to irregular printing surfaces, resulting in the need for less pressure and preparation. It has improved print quality of text and halftones on rough surfaced papers. Further, the substrate does not contact the printing plate thereby increasing plate life and reducing abrasive wear. Also, the image on the plate is right for reading rather than reverse reading. Finally, less ink is required for equal coverage, drying is speeded, and smudging and setoff are reduced. Setoff is a

condition that results when wet ink on the surface of the press sheets transfers or sticks to the backs of other sheets in the delivery pile.

Thus, in summary, conventional lithographic offset printing machines or presses comprise one or more image printing stations each having a printing roller or a plate cylinder to which is fastened a thin hydrophilic, oleophobic printing plate having image areas which are oleophilic and hydrophobic and background areas which are oleophobic and hydrophilic. The plate surface is continuously wetted with an aqueous damping solution which adheres only to the background areas and inked with oleo-resinous inks which adhere only to the image areas of the plate as wet ink. The ink is offset transferred to the rubber surface of a contacting blanket cylinder and then retransferred to the receptive surface of a copy web or a succession of copy sheets, such as paper, with an impression cylinder and the ink air dries by oxidation and curing after passing through a drying station.

It is also known to provide the printing machine with a downstream coating station having a blanket roller associated with a coating application unit for the application of an overall protective coating over the entire printed area of the copy sheets or web.

It is known to apply pattern coatings of protective composition by means of blanket rolls by cutting into the rubber surface of the blanket to create raised or relief surface areas which selectively receive the coating composition from the application roll for retransfer to selected areas of the copy sheets in form of pattern coatings. See U.S. Pat. No. 4,796,556.

Lithographic inks are formulated to print from planographic surfaces which use the principle that grease and water do not mix. Lithographic inks are generally very strong in color value to compensate for the lesser amount applied. They are among the strongest of all inks. The average amount of ink transferred to the paper is about half that of letter press because of the double split of the ink film between the plate cylinder and the blanket cylinder and the blanket cylinder and the substrate on the impression cylinder.

Problems occur in the offset lithographic process when attempting to print certain colors such as white and in particular white on other colors such as yellow because the color white will be faint and not sufficiently strong. In such cases, the sheet or paper or substrate requiring the white ink usually has to be run through the same printer several times before the white becomes sufficiently strong.

Further, such colors are not generally printable in an offset lithographic printing process. This means that the sheets or substrate must be removed and transferred to a second type of machine using the flexographic process to apply greater amounts of ink in successive printing runs to achieve the desired print quality.

A like situation occurs with the printing of slurry-type materials such as "scratch-and-sniff" materials which is a liquid vehicle with a slurry containing an encapsulated essence. Such liquid vehicles, because of the nature of the slurry, must be printed with a flexographic process because the anilox roller can supply greater amounts of ink to the flexo [flexographic] plate on the plate cylinder.

Again, when a liquid vehicle with a slurry having suspended material therein such as metallic particles is to be printed, an offset lithographic process cannot be used without the mixing of the aqueous solution with metallic inks which cause a dulling of the image. Further, the above-mentioned double split of the ink film adds to the dulling of the image. Therefore, to achieve desired results, the printing must take place with a flexographic printing machine.

Thus, liquid opaque coatings or inks such as white colored ink, scratch-and-sniff vehicles, and slurries with metal particles do not achieve desired results when printed in an offset lithographic process and must be transferred from the offset lithographic in-line machines to a separate machine for printing in a separate run.

Such requirements not only hinder the speed of the printing process but also require additional time and thus increase the cost of the printing.

It would be advantageous to have a continuous in-line process in which not only offset lithographic printing could take place but in which, in the same in-line process, liquid printing vehicles including opaque coatings, such as white ink, and slurries containing encapsulated essences or metallic particles could also be printed and dried not only before the printing of the offset lithographic inks but also in which, after the liquid opaque coatings have been applied, an overcoating could be applied to the printed liquid vehicle image using the lithographic process in the continuous in-line process.

SUMMARY OF THE INVENTION

The present invention provides for a continuous in-line printing process having a plurality of successive printing stations for printing color images on a substrate. At least one of the stations prints a liquid vehicle image on a substrate with an opaque coating using the flexographic process and at least one of the successive printing stations printing a second color image over the liquid vehicle image on the printed substrate using the lithographic process in the continuous in-line process.

In the novel inventive system, a single in-line continuous printing process is used. One of the stations may print a liquid vehicle image on a substrate that contains a slurry with an encapsulated essence therein utilizing the flexographic process. Another one of the stations may apply an overcoating over the liquid vehicle image on the printed substrate using a lithographic process. Still another of the stations may print an aqueous-based vehicle image including a suspended metallic material therein using the flexographic process to form a metallic coating and thereafter at least one of the successive printing stations prints a color image over the aqueous-based vehicle image using the lithographic offset process in the continuous in-line process.

Whenever a station is used for flexographic printing a flexographic plate [image] is placed on the blanket cylinder for receiving the liquid vehicle and transferring the liquid vehicle to the receptive surface of the copy web or succession of copy sheets on the impression cylinder for printing. Anilox roller is associated with the flexographic plate for supplying the liquid vehicle which may be an aqueous bared vehicle.

In addition, in such case, a high-velocity air dryer is associated with the impression cylinder of one or more of the printing stations where the printing on the substrate is occurring to assist in drying the ink or liquid vehicle printed on the substrate while it is on or near the impression cylinder, before the substrate arrives at the next successive station for additional printing, or before printing occurs at the next successive station.

Thus, if a liquid vehicle such as white ink is to be printed, it is printed with a flexographic process which deposits a greater amount of ink on the substrate, the ink is dried with a high-velocity air dryer while the substrate is on or near the impression cylinder and prior to the substrate being received by the next successive station. If desired, at the next successive station the printing of the white liquid vehicle may again take place thus ensuring the desired intensity of

whiteness on the substrate. Subsequently, at the next succeeding station a printing may take place on top of the white printing and such printing may continue at the remaining successive stations.

Thus, it is an object of the present invention to provide a plurality of successive printing stations for printing color images on a substrate in a continuous in-line process and in which some of the stations print using the flexographic process and other of the stations print utilizing the offset lithographic process.

It is also an object of the present invention to print an aqueous-based vehicle image including a suspended metallic material therein using the flexographic process at one printing station and at least one successive printing station printing a color image over the aqueous-based vehicle image using a lithographic process in a continuous in-line process or placing an overcoating over the aqueous-based vehicle image using the flexographic process and then printing at successive stations using the lithographic process.

It is yet another object of the present invention to provide a continuous in-line printing process in which one of the stations prints a liquid vehicle image on the substrate with a slurry containing an encapsulated essence using the flexographic process and at least one of the successive printing stations applies an overcoating over the liquid vehicle image on the printed substrate using the offset lithographic process in a continuous in-line process.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of the present invention will be more fully disclosed when taken in conjunction with the following DETAILED DESCRIPTION OF THE PRESENT INVENTION in which like numerals represent like elements and in which:

FIG. 1 is a schematic view of a prior art offset lithography printing station;

FIG. 2 is a generalized depiction of a printing station that may be used either as an offset lithographic station or a flexographic printing station and illustrates how the station may be converted from an offset lithographic station to a flexographic station; and

FIG. 3 illustrates the continuous in-line process of the present invention comprising a plurality of printing stations, each of which can be converted from an offset lithographic printing station to a flexographic printing station as well as a final coating station.

DETAILED DESCRIPTION OF THE PRESENT INVENTION

FIG. 1 is a schematic representation of a well-known offset lithography printing station 10 having a plate cylinder 12, a blanket cylinder 14, and an impression cylinder 16. The printing medium or substrate, such as paper 20 either in sheet form or web, is fed over the impression cylinder 16 in printing contact with the blanket cylinder 14 to receive the image and then passes over the paper transfer cylinder 18 with the image printed thereon. An inking system 26, well known in the art, transfers the ink from the ink supply to the plate cylinder 12. This is a typical offset lithography printing station.

As disclosed in U.S. Pat. No. 4,796,556, offset lithographic printing machines generally have a plurality of in-line liquid application stations at least one of which is an ink image printing station for printing lithographic ink images on to suitable receptive copy sheets. The final

downstream liquid application station is a coating application station for printing a protective and/or aesthetic coating over selected portions of or over the entire ink-image printed surface of the copy sheets and can also be used to print metallic coatings or slurry. As stated in U.S. Pat. No. 4,796,556, two liquid application stations are shown, the latter including a coating apparatus and the first station being a conventional offset image printing station. The coating application printing station is one that can be modified to convert it either permanently or intermittently to a coating station from an offset lithographic station.

Such a station is illustrated in FIG. 2 herein. The station **30** comprises a housing **32** which includes therein a plate cylinder **34** that is fed with an ink system of rollers **36** that take ink from an ink supply **38** and transfer it to the plate cylinder **34**. A blanket cylinder **40** is in ink transfer relationship with the plate cylinder **34** and the impression cylinder **42** where the image is transferred to a substrate passing between blanket cylinder **40** and impression cylinder **42** as blanket cylinder **40** rotates in the direction of arrow **52**. This is a conventional offset lithographic printing station. When it is desired to convert that station into a coater station, the coater apparatus **43** has a coater head **44** including a supply of liquid coating and an anilox roller **46** that can be moved such that it can be in contact with either the blanket cylinder **40** for direct printing or the plate cylinder **34** for offset printing. In this case, the ink rollers **36** for the lithographic system are removed from engagement with the plate cylinder **34** in a well-known manner. The coater unit **43** includes a motor device **45**, an arm **47**, and a pivotal connection **48** that connects the coater head **44** with the remainder of the assembly.

As stated previously, the offset lithographic machine of FIG. **2** is converted as shown therein to a coater that is used only in the last stage of an in-line printing process. It has not been able to be used in stages other than the last printing station because the ink that is placed on the blanket cylinder by means of an anilox roller is still wet when it arrives at the subsequent stations, thus causing smearing of the printed material and causing a general impossibility of printing other information thereon. However, applicant has modified the station shown in FIG. **2** by the addition of a high-velocity air dryer **50** that is associated with the impression cylinder **42** directly after the ink is transferred from the blanket cylinder to the substrate on the impression cylinder. Thus by using flexographic inks, or aqueous coatings which are naturally quick-drying inks, and the high-velocity air dryer **50** located at the point where the ink is applied to the substrate on the impression cylinder, the ink is sufficiently dried when it passes to the next station that further printing can take place on the printed substrate.

Thus, as shown in FIG. **3**, a conventional in-line offset lithographic printing machine **52** is shown having an apparatus to feed paper into the said machine, referred to as a feeder **54**, printing stations **56**, **58**, **60**, **62**, and **64** and a coating station **66**. A delivery station **68** receives the printed material or substrates. Thus there are a plurality of successive printing stations **56**, **58**, **60**, **62**, and **64** for printing color images on the substrate in a continuous in-line process. Any one of the printing stations **56–64** can be modified as generally shown therein and as illustrated in FIG. **2** to print a first color image using the flexographic process. The succeeding printing stations can then print a second color image over the first color image using the lithographic process in the continuous in-line process. As illustrated in FIG. **2**, the flexographic process printing station includes the blanket cylinder **40** and the impression cylinder **42**. A

flexographic plate 41 on the blanket cylinder 40 has an image thereon for receiving the first color from the anilox roller 46 and transferring that first color image to the impression cylinder 42 for printing on the substrate. The high-velocity air dryer 50 thus dries the flexographic ink on the substrate and passes the substrate to the subsequent printing station. Thus in FIG. 3, station 56 may be modified as generally shown therein and as illustrated in FIG. 2 and a flexographic ink can be printed thereon at station 56, dried by the high-velocity air dryer 50, and coupled to subsequent in-line stations 58–64 for further printing a second or more color images over the first color image using the offset lithographic process in a continuous in-line process. The flexographic printing station shown in FIG. 2 may print a liquid vehicle image on the substrate with a slurry containing an encapsulated essence. At at least one of the successive printing stations 58–64 an overcoating may be applied over the liquid vehicle image on the printed substrate using the flexographic process in the continuous in-line process. The overcoating may be an aqueous overcoating, or an ultraviolet overcoating. In addition, the substrate may be a sheet or a web 20 as illustrated in FIG. 1 or it may be single sheet fed in the continuous in-line process from the stack sheets shown at 54 in FIG. 3.

Further, the modified flexographic printing station 30 shown in FIG. 2, as stated previously, may be any one of the stations 56–64 in FIG. 3, and as illustrated by stations 56 and 58, and may print an aqueous-based vehicle image including a suspended metallic material therein using the flexographic process to form a metallic coating. Again, after it is dried by the high-velocity air dryer 50, it may be passed to one of the successive printing stations for printing a color image over the aqueous-based vehicle image using the offset lithographic process in the continuous in-line process. The suspended material may include uniform-sized metal particles to form the metallic coating or it may include nonuniform or multiple-sized metal particles to form the metallic coating.

The present invention is especially useful when a liquid opaque coating must be printed such as a white color ink. In that case, it may be desirable to have both stations 56 and 58 modified as shown in FIG. 3 and as illustrated in detail in FIG. 2. In such case, the anilox roller 46 at each station delivers the white ink in the same pattern to the flexographic plate 41 on the blanket cylinder 40 for transfer to the substrate on the impression cylinder 42. As the substrate passes the high-velocity drying station 50, the ink is dried and the second station may again print the same white pattern on the substrate to increase the quality of the white ink appearance after it is applied to the substrate.

Thus, the station or stations that are converted to flexographic printing stations may have an ink-providing means 46 at the printing station for applying a flexographic ink to the blanket cylinder to form the image. A substrate receives the flexographic ink image transfer from the blanket cylinder and at least one subsequent printing station in the in-line process receives the image-printed substrate and prints an additional coated ink image on the substrate on top of the flexographic ink image using offset lithography. The additional colored ink images that can be printed on top of the flexographic ink images can be conventional lithographic inks or waterless inks.

Further, the colored ink images may be printed with halftone screening processes. The flexographic ink image and the colored ink images may also be printed in solids and/or halftone printing plates in sequence and in registry in successive printing stations to produce a multicolored image on the substrate. Further, the printing apparatus may include a sheetfed press or a web press.

In the present invention, at least one of the flexographic printing stations prints an image with liquid vehicle slurry containing an encapsulated essence. In another embodiment, at least one of the printing stations prints an image with a water-based liquid vehicle containing suspended particles that are either uniform or nonuniform in size. The suspended particles may be metallic particles up to substantially 16 microns in diameter.

The present invention may also use the metallic color printing process as disclosed in commonly assigned U.S. Pat. No. 5,370,976 incorporated herein by reference in its entirety.

In one aspect, the novelty of the present invention is to create a flexographic printing station that can be used at one of a plurality of printing stations in a continuous in-line process and in which, at a subsequent printing station, a lithographic process may be used to print over the liquid vehicle printed by the flexographic station.

Thus, there has been disclosed an apparatus for a combined lithographic/flexographic printing process that includes a plurality of successive printing stations for printing color images on a substrate in a continuous in-line process and wherein one of the stations prints a first color image using the flexographic process and at least one of the successive printing stations prints a second color image over the first color image using the lithographic process in the continuous in-line process.

While the invention has been described in connection with a preferred embodiment, it is not intended to limit the scope of the invention to the particular form set forth, but, on the contrary, it is intended to cover such alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

We claim:

1. Apparatus for a combined lithographic/flexographic printing process comprising:

a substrate;

a plurality of successive printing stations for printing color images on the substrate in a continuous in-line process;

one of said stations comprising a flexographic printing station for printing a liquid vehicle image on said substrate with a slurry containing an encapsulated essence using the flexographic process;

at least one of said successive printing stations being a lithographic printing station; and

an overcoating applied over the liquid vehicle image on the printed substrate at at least one of said successive lithographic printing stations using the lithographic process in said continuous in-line process.

2. Apparatus as in claim 1 wherein said overcoating is an aqueous overcoating.

3. Apparatus as in claim 1 wherein said overcoating is an ultraviolet ink overcoating.

4. Apparatus as in claim 1 wherein:

said substrate is a paper sheet; and

said apparatus includes a sheet feeder.

5. Apparatus as in claim 1 wherein:

said substrate is a web; and

said apparatus includes a web feeder.

6. Apparatus for a combined lithographic/flexographic printing process comprising:

a plurality of successive printing stations for printing color images on a substrate in a continuous in-line process;

one of said stations comprising a flexographic printing station printing an aqueous-based vehicle image using the flexographic process to form a metallic coating;

a suspended metallic material being included in said aqueous-based vehicle image; and

at least one of the successive printing stations comprising an offset lithographic printing station printing a color image over the aqueous-based vehicle image using the offset lithographic process in said continuous in-line process.

7. Apparatus as in claim 6 wherein said suspended material includes uniform-sized metal particles to form said metallic coating.

8. Apparatus as in claim 6 wherein said suspended material includes nonuniform-sized metal particles to form said metallic coating.

9. Apparatus as in claim 6 further including: said flexographic printing station including a plate cylinder having a flexographic plate thereon, a blanket cylinder, and an impression cylinder;

a flexographic plate image transferred from said plate cylinder to said blanket cylinder, said image being formed of said metallic coating, said blanket cylinder transferring said metallic coating to said impression cylinder for printing said flexographic plate image on said substrate; and

an anilox roller associated with said flexographic plate for supplying said aqueous-based vehicle containing said suspended metallic material to said flexographic plate.

10. Apparatus for creating a combined lithographic/flexographic printing process comprising:

a plurality of successive printing stations for printing color images on a substrate in a continuous in-line process;

one of said stations comprising a flexographic printing station for printing a first color image using the flexographic process; and

at least one of the successive printing stations comprising an offset lithographic printing station for printing a second color image over the first color image using the offset lithographic process in said continuous in-line process.

11. Apparatus as in claim 10 further including:

said flexographic printing station including a plate cylinder, a blanket cylinder, and an impression cylinder;

a flexographic plate on said plate cylinder;

an anilox roller associated with said flexographic plate for supplying a first color to said flexographic plate to form said first color image; and

said blanket cylinder receiving said first color image from said plate cylinder and transferring said first color image to said impression cylinder for printing on said substrate.

12. (Amended) Apparatus for creating a combined lithographic/flexographic printing process comprising:

a substrate;

a plurality of successive printing stations for printing color images on the substrate in a continuous in-line process;

at least two successive ones of said printing stations being flexography stations and comprising:

(1) a supply of liquid coating;

(2) a plate cylinder associated with a blanket cylinder, said plate cylinder having a flexographic plate thereon;

(3) an anilox roller associated with said liquid supply coating and said plate cylinder for delivering said liquid coating to said flexographic plate to form an image for transfer to said blanket cylinder;

(4) an impression cylinder holding said substrate for receiving said liquid coating image transferred from said blanket cylinder and printing said image on said substrate[,];

said at least two flexography stations printing the same liquid coating image in sequence and in superimposed relationship; and

at least one offset lithographic printing station [for] receiving said substrate and printing over said liquid coating image.

13. Apparatus as in claim 12 wherein said liquid coating image printed on said substrate is a white color ink.

14. Apparatus as in claim 12 further including an air dryer associated with each of said impression cylinders on said flexography stations, said air dryer having sufficient air velocity for drying said liquid coating before the substrate is transferred to the successive printing station in said continuous in-line process.

15. Apparatus for a combined lithographic/flexographic printing process comprising:

a plurality of successive printing stations for printing color images on a substrate in a continuous in-line process, said printing stations including both lithographic and flexographic printing stations;

a blanket cylinder at at least a first one of said flexographic printing stations;

flexographic ink-providing means at said at least first one of said flexographic printing stations for applying a flexographic ink to said blanket cylinder to form an image;

a substrate for receiving said flexographic ink image transferred from said blanket cylinder; and

at least one subsequent lithographic printing station in said in-line process for receiving said image printed substrate and printing an additional colored ink image on said substrate on top of said flexographic ink image using offset lithography.

16. Apparatus as in claim 15 further comprising:

a plate cylinder at said at least first one of said flexographic stations;

a flexographic plate on said plate cylinder for receiving and transferring said flexographic ink to said blanket cylinder; and

said flexographic ink-providing means including a flexographic ink supply and an anilox roller associated with said flexographic ink supply for transferring said flexographic ink to said flexographic plate.

17. Apparatus for a combined lithographic/ flexographic printing process for printing a multicolored image comprising:

a plurality of successive printing stations for printing color on a substrate in a continuous in-line process, said printing stations including both lithographic and flexographic printing stations;

at least one of said flexographic printing stations having:

(1) a plate cylinder and a blanket cylinder, said plate cylinder including a flexographic plate having an image thereon for transferring a flexographic color ink image to said blanket cylinder;

(2) an etched anilox roller for applying a flexographic color ink to said flexographic plate on said plate cylinder;

(3) an impression cylinder in ink-transfer relationship with said blanket cylinder for transferring said flexographic color ink image from said blanket cylinder to said substrate; and

at least one of said succeeding printing stations being a lithographic printing station using offset lithography for printing additional colored ink images on top of said flexographic ink image.

18. Apparatus as in claim 17 wherein said additional colored ink images are formed with lithographic inks.

19. (Amended) Apparatus as in claim 17 wherein at least one of the said colored ink images [are] is formed with a waterless [inks] ink.

20. (Amended) Apparatus as in claim 17 further including an air dryer adjacent to said impression cylinder for drying the colored flexographic ink image transferred to said substrate before said additional colored ink images are printed thereon.

21. Apparatus as in claim 17 further including halftone printing plates for printing said colored ink images.

22. (Amended) Apparatus as in claim 17 wherein said colored flexographic ink image and said lithographic colored ink images are printed as solid colors and/or with halftone printing plates in sequence and in registry in said successive printing stations to produce said multicolored image on said substrate.

23. Apparatus as in claim 17 wherein said printing apparatus includes a sheet-fed press.

24. Apparatus as in claim 17 wherein at least one of said flexographic printing stations prints said flexographic ink image with liquid vehicle slurry containing an encapsulated essence.

25. Apparatus as in claim 17 wherein at least one of said printing stations prints said flexographic ink image with a water-based liquid vehicle containing suspended particles.

26. Apparatus as in claim 25 wherein said suspended particles are uniform in size.

27. Apparatus as in claim 25 wherein said suspended particles are nonuniform in size.

28. Apparatus as in claim 25 wherein said suspended particles are metallic particles.

29. A method of combining lithography and flexographic printing in a continuous in-line process comprising the steps of:

providing a plurality of successive lithographic/flexographic printing stations for printing colored ink images on a substrate;

printing a flexographic ink image on said substrate at at least one of said flexographic stations;

transferring said printed substrate to at least one subsequent printing station in said continuous in-line process; and

printing colored ink images [on top of] over said flexographic ink image at at least one of said subsequent lithographic printing stations with an offset lithographic process.

30. A method as in claim 29 further comprising the step of drying said flexographic ink image on said substrate with an air dryer prior to printing said colored ink images thereon.

31. A method as in claim 29 further including the step of printing a coating on top of said colored ink images at one of said plurality of subsequent printing stations.

32. A method as in claim 29 wherein said colored inks forming said colored ink images are waterless.

33. A method as in claim 29 wherein said colored inks forming said colored ink images are in a solvent-based liquid vehicle.

34. (Amended) A method as in claim 29 further including the steps of: printing a slurry on said substrate at any of said printing stations in said continuous in-line process;

using an encapsulated essence in said slurry; and

printing an overcoating [over] on top of said slurry at a subsequent printing station in said in-line process to protect said essence.

35. A method as in claim 34 further including the step of printing an aqueous-based coating over said slurry.

36. A method as in claim 34 further including the step of printing an ultraviolet coating over said slurry.

37. A method of combining offset lithography and flexographic printing in a continuous in-line process comprising the steps of:

providing a substrate;

applying a flexographic ink to a blanket cylinder in a pattern with a coating head at a first flexographic printing station;

transferring said pattern of flexographic ink from said blanket cylinder to the substrate; and

printing a waterless ink pattern over said flexographic ink pattern on said substrate at at least one subsequent offset lithographic printing station in said continuous in-line process.

38. A method of combining lithography and flexographic printing in a continuous in-line process comprising the steps of:

printing an aqueous-based vehicle image having suspended particles therein on a substrate at a first flexographic printing station;

transferring said image printed substrate to at least one additional printing station in said continuous in-line process; and

printing additional colored ink images on said printed substrate over said aqueous-based vehicle image in an offset lithographic process at said at least one additional printing station in said in-line process.

39. A method of combining lithography and flexographic printing in a continuous in-line process comprising the steps of:

(1) providing a plurality of successive printing stations for printing liquid vehicle images on a substrate in said in-line continuous process;

(2) utilizing an anilox roller to transfer a liquid ink as said liquid vehicle to a flexographic plate image at at least one of said printing stations;

(3) printing said liquid ink from said flexographic plate image to a substrate;

(4) transferring said printed substrate with said liquid ink image to a subsequent printing station in said in-line printing process;

(5) repeating steps (2)-(4) at subsequent printing stations in said in-line process to achieve a desired opacity ink image on said substrate; and

(6) printing an ink pattern over said flexographic ink image using an offset lithographic process.

40. A method as in claim 39 further including the step of additionally printing colored ink images over said liquid ink image on said substrate at subsequent ones of said printing stations in said in-line process.

41. A method as in claim 40 wherein said liquid ink is an opaque white color.

42. The apparatus of any of claims 1, 6, 10, 12, 15 and 17, wherein the substrate is printed on both sides in one pass during the continuous in-line process.

43. The method of any of claims 29, 37, 38 or 39 wherein the substrate is printed on both sides in one pass during the continuous in-line process.

44. Apparatus for a combined lithographic/flexographic printing process comprising:

a substrate;

a plurality of successive printing stations for depositing a series of images on one side of a substrate in a continuous in-line process;

one of said stations comprising a flexographic printing station for printing a liquid vehicle image on said substrate using a flexographic process; and

at least one of said successive printing stations being a lithographic printing station;

whereby said substrate is printed on top of or on the opposite side of that previously printed at at least one of said successive lithographic printing stations using the lithographic process in said continuous in-line process.

45. Apparatus as in claim 44 wherein at least one of said images at the flexographic station is a coating material.

46. Apparatus as in claim 44 wherein at least one of said images at one of the lithographic stations is an ink.

47. Apparatus as in claim 44 wherein:

said substrate is a paper sheet; and

said apparatus includes a sheet feeder.

48. Apparatus as in claim 44 wherein:

said substrate is a web; and

said apparatus includes a web feeder.

49. An apparatus for a combined lithographic/flexographic printing process comprising:

a plurality of successive printing stations for depositing a series of images on a substrate in a continuous in-line process;

one of said stations comprising a flexographic printing station printing an aqueous-based vehicle on one side of the substrate using the flexographic process to form a metallic coating image;

a suspended metallic material being included in said aqueous-based vehicle; and

at least one of the successive printing stations comprising an offset lithographic printing station printing a color image on top of the aqueous-based vehicle or on the opposite side to that previously printed using the offset lithographic process in said continuous in-line process.

50. Apparatus for creating a combined lithographic/flexographic printing process comprising:

a plurality of successive printing stations for depositing a series of images on a substrate in a continuous in-line process;

one of said stations comprising a flexographic printing station for printing a first color image using the flexographic process; and

at least one of the other successive printing stations comprising an offset lithographic printing station for printing a second color image on the reverse side of the substrate of the first color image using the offset lithographic process in said continuous in-line process.

51. Apparatus as in claim 49 wherein said suspended material includes nonuniform-sized metal particles to form said metallic coating.

52. Apparatus as in claim 49 further including: said flexographic printing station including a plate cylinder having a flexographic plate thereon, a blanket cylinder, and an impression cylinder;

a flexographic plate image transferred from said plate cylinder to said blanket cylinder, said image being formed of said metallic coating, said blanket cylinder transferring said metallic coating to said impression cylinder for printing said flexographic plate image on said substrate; and

an anilox roller associated with said flexographic plate for supplying said aqueous-based vehicle containing said suspended metallic material to said flexographic plate.

53. Apparatus for creating a combined lithographic/flexographic printing process comprising:

a plurality of successive printing stations for depositing a series of images on a substrate in a continuous in-line process;

one of said stations comprising a flexographic printing station for printing a first color image using the flexographic process; and

at least one of the other successive printing stations comprising an offset lithographic printing station for printing a second color image on the reverse side of the substrate of the first color image using the offset lithographic process in said continuous in-line process.

54. Apparatus as in claim 53 further including:

said flexographic printing station including a plate cylinder, a blanket cylinder, and an impression cylinder;

a flexographic plate on said plate cylinder;

an anilox roller associated with said flexographic plate for supplying a first color to said flexographic plate to form said first color image; and

said blanket cylinder receiving said first color image from said plate cylinder and transferring said first color image to said impression cylinder for printing on said substrate.

55. Apparatus for creating a combined lithographic/flexographic printing process comprising:

a substrate;

a plurality of successive printing stations for depositing a series of images on a substrate in a continuous in-line process;

at least one of said printing stations being flexographic stations and comprising:

(1) a supply of liquid coating;

(2) a plate cylinder associated with a blanket cylinder, said plate cylinder having a flexographic plate thereon;

(3) an anilox roller associated with said liquid supply coating and said plate cylinder for delivering said liquid coating to said flexographic plate to form an image for transfer to said blanket cylinder;

(4) an impression cylinder for receiving said liquid coating image transferred from said blanket cylinder and printing said image on one side of said substrate; and

at least one offset lithographic printing station for receiving said substrate and printing on top of or on the opposite side to that previously printed.

56. Apparatus as in claim 55 wherein said liquid coating image printed on said substrate is a white color ink.

57. Apparatus as in claim 56 further including an air dryer associated with each impression cylinder on each flexographic station, said air dryer having sufficient air velocity for drying said liquid coating before the substrate is transferred to the successive printing station in said continuous in-line process.

58. Apparatus for a combined lithographic/ flexographic printing process comprising:

a plurality of successive printing stations for depositing a series of images on a substrate in a continuous in-line process, said printing stations including both lithographic and at least two flexographic printing stations;

a blanket cylinder at at least a first one of said flexographic printing stations;

flexographic ink-providing means at the other of said flexographic printing stations for applying a flexographic ink to said blanket cylinder to form an image on one side of a substrate;

a substrate for receiving said flexographic ink image transferred from said blanket cylinder; and

at least one subsequent lithographic printing station in said in-line process for receiving said image printed substrate and printing an additional colored ink image on said substrate on top of said flexographic ink image or the opposite side to that previously printed using offset lithography.

59. Apparatus as in claim 58 further comprising:

a plate cylinder at said at least first one of said flexographic stations;

a flexographic plate on said plate cylinder for receiving and transferring said flexographic ink to said blanket cylinder; and

said flexographic ink-providing means including a flexographic ink supply and an anilox roller associated with said flexographic ink supply for transferring said flexographic ink to said flexographic plate.

60. Apparatus for a combined lithographic/ flexographic printing process for printing a multicolored image comprising:

a plurality of successive printing stations for depositing a series of images on a substrate in a continuous in-line process, said printing stations including both lithographic and flexographic printing stations;

at least one of said flexographic printing stations having:

(1) a plate cylinder and a blanket cylinder, said plate cylinder including a flexographic plate having an image thereon for transferring a flexographic color ink image to said blanket cylinder;

(2) an etched anilox roller for applying a flexographic color ink to said flexographic plate on said plate cylinder;

(3) an impression cylinder in ink-transfer relationship with said blanket cylinder for transferring said flexographic color ink image from said blanket cylinder to one side of said substrate; and

at least one of said succeeding printing stations being a lithographic printing station using offset lithography for printing additional colored ink images on top of said flexographic ink image or on the opposite side to that that previously printed.

61. Apparatus as in claim 60 wherein said additional colored ink images are formed with lithographic inks.

62. Apparatus as in claim 60 wherein at least one of said colored ink images is formed with a waterless ink.

63. Apparatus as in claim 60 further including an air dryer adjacent to said impression cylinder for drying the colored flexographic ink image transferred to said substrate before said additional colored ink images are printed thereon.

64. Apparatus as in claim 60 further including halftone printing plates for printing said colored ink images.

65. Apparatus as in claim 60 wherein said colored flexographic ink image and said lithographic colored ink images are printed as solid colors and/or with halftone printing plates in sequence and in registry in said successive printing stations to produce said multicolored image on said substrate.

66. Apparatus as in claim 60 wherein said printing apparatus includes a sheet-fed press.

67. Apparatus as in claim 60 wherein at least one of said flexographic printing stations prints said flexographic ink image with liquid vehicle slurry containing an encapsulated essence.

68. Apparatus as in claim 60 wherein at least one of said printing stations prints said flexographic ink image with a water-based liquid vehicle containing suspended particles.

69. Apparatus as in claim 68 wherein said suspended particles are uniform in size.

70. Apparatus as in claim 68 wherein said suspended particles are nonuniform in size.

71. Apparatus as in claim 68 wherein said suspended particles are metallic particles.

72. A method of combining lithography and flexographic printing in a continuous in-line process comprising the steps of:

providing a plurality of successive lithographic/ flexographic printing stations for depositing a series of images on a substrate;

printing an image as one of said thin controlled layers on one side of said substrate at at least one of said flexographic stations;

transferring said printed substrate to at least one subsequent printing station in said continuous in-line process; and

printing an image on the reverse side of said substrate having said flexographic ink image, at at least one of said other subsequent lithographic printing stations with an offset lithographic process in the continuous in-line process.

73. A method as in claim 72 further comprising the step of drying said flexographic ink image on said substrate with an air dryer prior to printing said colored ink images thereon.

74. A method as in claim 72 further including the step of printing a coating on top of said colored ink images at one of said plurality of subsequent printing stations.

75. A method as in claim 72 wherein said colored inks forming said colored ink images are waterless.

76. A method as in claim 72 wherein said colored inks forming said colored ink images are in a solvent-based liquid vehicle.

77. A method as in claim 72 further including the steps of:

printing a slurry on one side of said substrate at any of said printing stations in said continuous in-line process;

using an encapsulated essence in said slurry; and

printing an ink on the reverse side of said substrate at a subsequent printing station in said in-line process.

78. A method as in claim 77 further including the step of printing an aqueous-based coating over said slurry.

79. A method as in claim 77 further including the step of printing an ultraviolet coating over said slurry.

80. A method of combining offset lithography and flexographic printing in a continuous in-line process comprising the steps of:

providing a substrate;

applying an ink or coating to a blanket cylinder in a pattern with a coating head at a flexographic printing station;

transferring said pattern of ink or coating from said blanket cylinder to one side of the substrate; and

printing a waterless ink pattern on the reverse side of said substrate at at least one subsequent offset lithographic printing station in said continuous in-line process.

81. A method of combining lithography and flexographic printing in a continuous in-line process comprising the steps of:

printing an aqueous-based vehicle having suspended particles therein on one side of a substrate at a flexographic printing station to form an image;

transferring said image printed substrate to at least one additional printing station in said continuous in-line process; and

printing additional images on the reverse side of said printed substrate in an offset lithographic process at said at least one additional printing station in said in-line process.

82. A method of combining lithography and flexographic printing in a continuous in-line process comprising the steps of:

(1) providing a plurality of successive printing stations for depositing a series of images on a substrate in said in-line continuous process;

(2) utilizing an anilox roller to transfer a liquid ink as one of said thin controlled layers to a flexographic plate image at at least one of said printing stations;

(3) printing said liquid ink from said flexographic plate image to one side of a substrate;

(4) transferring said printed substrate with said liquid ink image to a subsequent printing station in said in-line printing process;

(5) repeating steps (2)-(4) at subsequent printing stations in said in-line process to achieve a desired opacity ink image on the one side of said substrate; and

(6) printing an ink pattern on the reverse side of said substrate using an offset lithographic process.

83. A method as in claim 82 further including the step of additionally printing ink images over said liquid ink image on said substrate at subsequent ones of said printing stations in said in-line process.

84. A method as in claim 83 wherein said liquid ink is an opaque white color.

85. A method of combining offset lithography and flexography using a plurality of successive printing stations in a continuous in-line process, at least one of said stations comprising a flexographic printing station for printing an image on said substrate using a flexographic process;

(1) printing an image at one or more of said printing stations on a substrate using an offset lithographic process;

(2) transferring said image printed substrate to an additional and flexographic printing station and printing at said flexographic and additional printing station a coating on all or part of said image on said substrate;

(3) transferring said substrate to one or more additional printing stations for printing the reverse side of the said substrate; and

(4) printing an image on said reverse side of said substrate at one of such one or more printing stations using an offset lithographic process in the continuous in-line process.

86. Apparatus for a combined offset lithographic and flexographic printing process comprising:

(1) a substrate;

(2) a plurality of successive printing stations for depositing a series of images selected from a group consisting of lithographic and flexographic inks, coatings and slurries on one or both sides of a substrate in a continuous in-line process;

(3) at least one of said stations comprising a flexographic printing station for printing an image on said substrate using a flexographic process;

(4) at least one of said successive printing stations being an offset lithographic printing station whereby said offset lithographic printing station is used to deposit one of said lithographic materials on either side of the said substrate in the continuous in-line process;

87. Apparatus for a combined offset lithographic/flexographic printing process comprising:

a plurality of successive printing stations for printing images on a substrate in a continuous in-line process, said printing stations including both offset lithographic and flexographic printing stations for depositing lithographic inks, and one or more flexographic inks, coatings and slurries on said substrate, whereby said lithographic inks, and one or more flexographic inks, coatings and slurries may be printed successively on one or both sides of said substrate in the continuous in-line process.

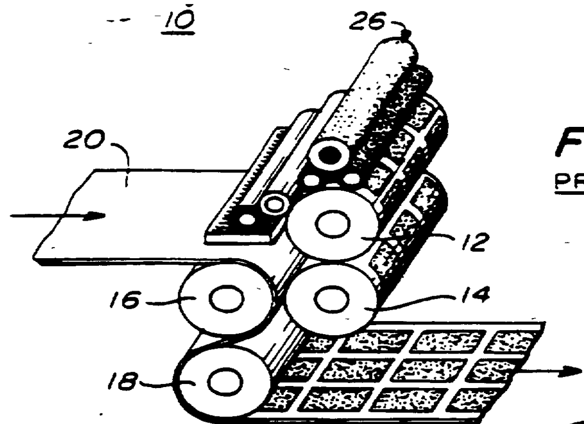

FIG. 1
PRIOR ART

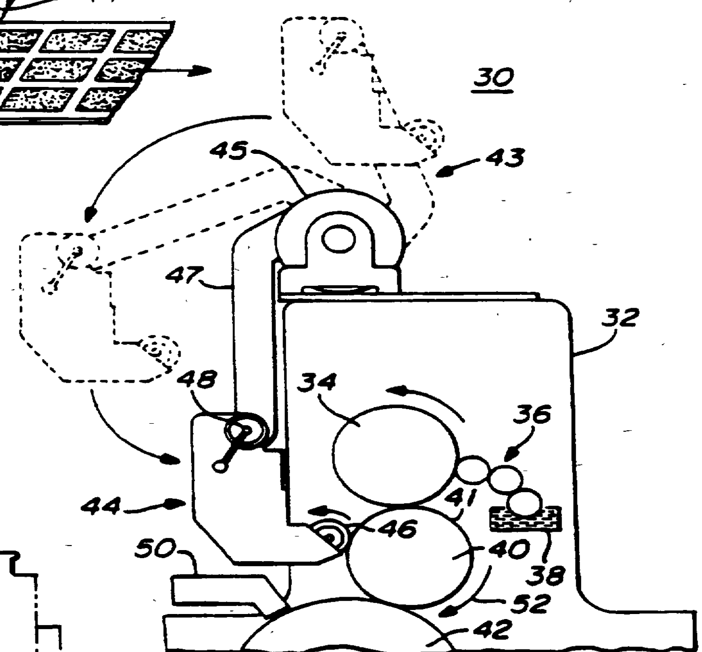

FIG. 2

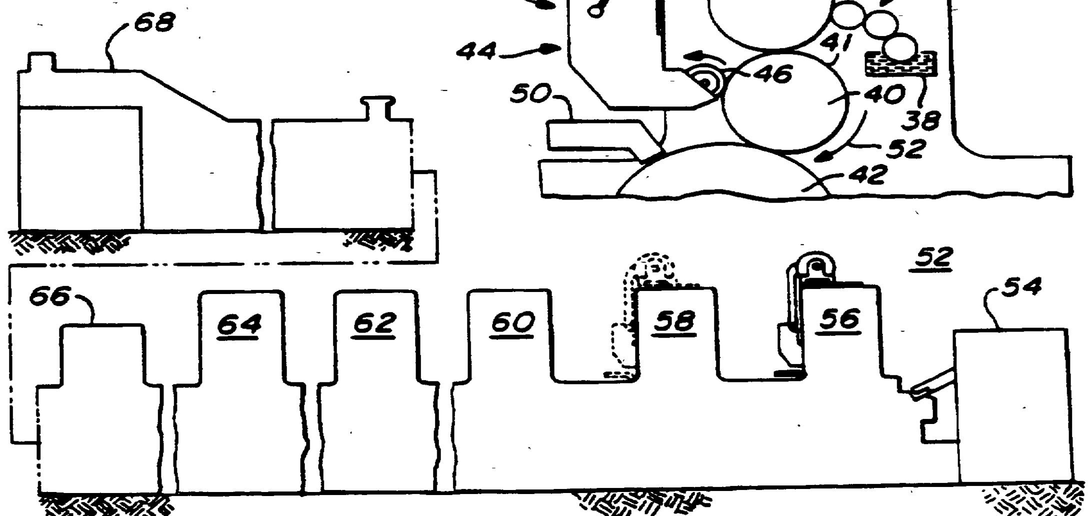

FIG. 3

Respectfully submitted,

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